Angka Giliran: _____

UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2006/2007

October/November 2006

REG 265 – Infrastructure Technology
(Teknologi Infrastruktur)

Duration: 3 hours
Masa: 3 jam

Please check that this examination paper consists of **NINE** pages of printed material before you begin the examination.

*Sila pastikan bahawa kertas peperiksaan ini mengandungi **SEMBILAN** muka surat yang tercetak sebelum anda memulakan peperiksaan ini.*

Students are allowed to answer all questions in English OR in Bahasa Malaysia.

Pelajar dibenarkan menjawab semua soalan dalam Bahasa Inggeris ATAU Bahasa Malaysia.

Answer **FIVE** questions only.

*Jawab **LIMA** soalan sahaja.*

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1. With the aid of sketches, discuss briefly these systems in electricity supply:-

Dengan bantuan lakaran, bincangkan secara ringkas sistem-sistem berikut dalam bekalan elektrik:-

(a) Generation system *(Sistem penjanaan)*

(b) Transmission system *(Sistem penghantaran)*

(c) Distribution system *(Sistem pengagihan)*

(d) National grid system *(Sistem grid nasional)*

(20 marks/*markah*)

2. (a) What is the definition of low voltage and list down the five criteria of it?

Apakah definisi voltan rendah dan senaraikan lima kriterianya?

(b) Calculate the number of substations needed to supply electricity for a 30 hectar housing scheme with these details (ADMD for each unit is given):-

Kirakan jumlah pencawang yang diperlukan untuk bekalan elektrik bagi satu skim perumahan seluas 30 hektar yang mempunyai butiran yang berikut (beban anggaran setiap unit seperti diberikan):-

140 single storey terrace house units [*unit rumah teres 1 tingkat* (1.2 kW)].
120 double storey terrace house units [*unit rumah teres 2 tingkat* (1.5 kW)].
60 double storey semi-detached house units [*unit rumah berkembar 2 tingkat* (1.5 kW)].
3 blocks of low cost flat houses with 210 accommodation units per block [*blok rumah pangsa kos rendah dengan 210 unit kediaman untuk 1 blok* (1.2 kW)].
2 blocks of medium cost flat houses with 150 accommodation units per block [*blok rumah pangsa kos sederhana dengan 150 unit kediaman untuk 1 blok* (1.5 kW)].
50 2 storey shop houses units [*unit rumah kedai 2 tingkat* (3.5 kW)].

Equation/(*Rumus*):-

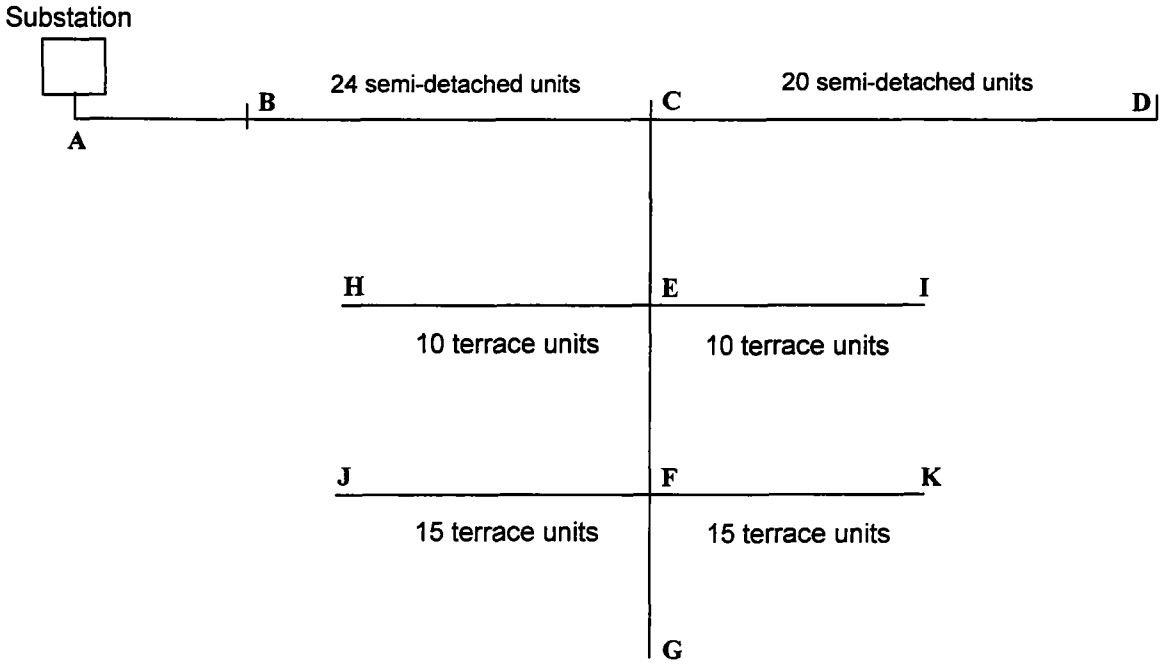
$$N = K\sqrt{\frac{Area \quad x \ ADMD}{1000}}$$

and*(dan)* K = 0.45

(20 marks/*markah*)

3. **Diagram 1** below shows the electricity supply network for a housing area. The width of the streets in front of the semi-detached and the terrace units are 12m and 6m respectively. Using **Table 1** and **Table 2**, calculate the volt drop.

Gambarajah 1 *di bawah menunjukkan rangkaian bekalan elektrik bagi satu kawasan perumahan. Lebar jalan di hadapan rumah berkembar ialah 12m manakala lebar jalan di hadapan rumah teres ialah 6 m. Dengan menggunakan* ***Jadual 1*** *dan* ***Jadual 2*** *yang diberi, kira kejatuhan voltan.*



Section	Distance (m)	Mains
AB	25	185 mm^2 PILC Cable
BC	200	100 mm^2 Bare Aluminium Overhead Mains
CD	200	100 mm^2 Bare Aluminium Overhead Mains
CE	24	50 mm^2 Bare Aluminium Overhead Mains
EF	80	50 mm^2 Bare Aluminium Overhead Mains
FG	120	50 mm^2 Bare Aluminium Overhead Mains
EH	95	19/.064 5-Foot-Way Mains
EI	95	19/.064 5-Foot-Way Mains
FJ	150	19/.064 5-Foot-Way Mains
FK	150	19/.064 5-Foot-Way Mains

Diagram 1(*Gambarajah 1)*

(20 marks/*markah*)

4. (a) You have been assigned to prepare the sewerage system for a layout plan of a proposed residential development. Describe all the criteria that you will have to consider in order to ensure the proper location selection of a sewage treatment plant.

Anda telah ditugaskan untuk menyediakan sistem pembetungan bagi satu pelan tatatur cadangan sebuah pembangunan residensi. Bincangkan semua kriteria yang anda perlu pertimbangkan untuk memastikan pemilihan lokasi loji rawatan kumbahan yang sesuai.

(10 marks/*markah*)

(b) With the aid of sketches, discuss the principle of sewage treatment of **ONE** of the following biological treatment methods:-

*Dengan bantuan lakaran, huraikan prinsip penyucian kumbahan **SATU** daripada kaedah rawatan biologi berikut:-*

(i) Activated Sludge (*Enapcemar Teraktif)*

(ii) Rotating Biological Contactor (*Kontaktor Biologi Berputar)*

(iii) Trickling Filter (*Turas Serapan)*

(10 marks/*markah*)

5. Using the data and formula given, calculate the surface water flowrate from the catchment areas of the surface water drainage in **Diagram 2**. Calculate also the drainage flowrate to determine whether it can convey the surface runoff produced. Use **Table 3** for your answers and submit together with the answer scripts.

Formula:

(a) $V = 0.33\ d^{2/3}\ s^{1/2}$

where : V - flow velocity (m/sec)
d - pipe diameter (mm)
s - slope (m/m)

(b) $i = \dfrac{760}{t + 10}$

where : i - rainfall intensity (mm/hr)
t - rainfall duration (minute)

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(c) $Q = 10^{-3}\ iA$

where : Q - surface runoff flowrate (m^3/hr)
i - rainfall intensity (mm/hr)
A - catchment area (m^2)

(d) Time of entry = 3 minutes

(20 marks/*markah*)

Dengan menggunakan data dan rumus yang diberikan, kira kadar aliran air larian permukaan daripada kawasan tadahan sistem perparitan air permukaan di ***Gambarajah 2****. Kira juga kadar aliran perparitan untuk menentukan sama ada ianya berupaya menyalurkan air larian yang terhasil. Guna* ***Jadual 3*** *yang dilampirkan untuk jawapan anda dan serahkan bersama skrip jawapan anda.*

Rumus

(a) $V = 0.33\ d^{2/3}\ s^{1/2}$

di sini: *V* - *halaju aliran (m/saat)*
d - *garispusat paip (mm)*
s - *cerun (m/m)*

(b) $i = \frac{760}{t + 10}$

di sini: *i* - *keamatan hujan (mm/jam)*
t - *jangka masa hujan (minit)*

(c) $Q = 10^{-3}\ iA$

di sini: *Q* - *kadar aliran air larian (m^3/jam)*
i - *keamatan hujan (mm/jam)*
A - *luas kawasan tadahan (m^2)*

(d) *Masa kemasukan = 3 minit*

(20 marks/*markah*)

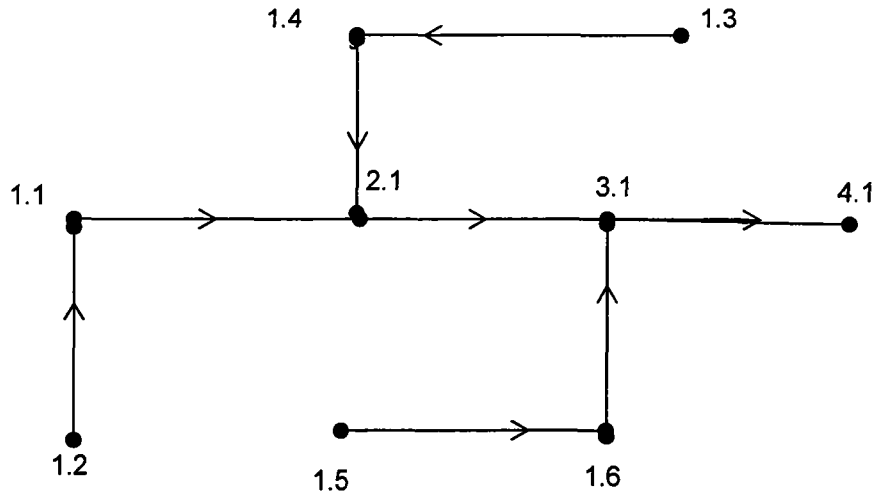

Diagram 2 (Gambar*ajah 2)*

6. (a) You are assigned to plan the water reticulation system of a proposed mixed residential development. Discuss the steps that you have to consider in order to decide whether an elevated water tower is needed or not.

Anda ditugaskan untuk merancang satu skim bekalan air untuk satu cadangan pembangunan residensi bercampur. Bincangkan langkah-langkah yang anda perlu ambil untuk menentukan sama ada tangki air menara diperlukan atau tidak.

(10 marks/*markah*)

(b) With the aid of sketches, discuss the main features and advantages/disadvantages of **ONE** of the following water distribution systems in comparison to the others:-

*Dengan bantuan lakaran, bincangkan ciri-ciri utama dan kelebihan/ kekurangan **SATU** daripada sistem agihan air berikut berbanding yang lain:-*

(i) Dead end system (*Sistem hujung mati)*

(ii) Grid system (*Sistem grid)*

(iii) Ring system (*Sistem Gelang)*

(iv) Arterial system (*Sistem Arteri)*

(10 marks/*markah*)

TABLE 1 *(JADUAL 1)*

Percentage Volt Drop of Mains and Services

Types	Size	Percentage Volt Drop per kVA-km		Percentage Volt Drop per KE-km at 0.85 p.f.	
		3 Phase	1 Phase	3 Phase	1 Phase
L.V. Overhead Bare Aluminium Mains	25 mm²	0.734	4.40	0.864	5.18
	50 mm²	0.412	2.47	0.485	2.91
	100 mm²	0.241	1.45	0.284	1.71
Insulated Aerial Cables (AMKA-T)	1 x 16 + 25 mm²	-	7.03	-	8.27
	3 x 16 + 25 mm²	1.18	-	1.39	-
	3 x 25 + 25 mm²	0.751	-	0.884	-
	3 x 35 + 25 mm²	0.552	-	0.649	-
	3 x 50 + 35 mm²	0.415	-	0.488	-
	3 x 70 + 50 mm²	0.296	-	0.348	-
	3 x 95 + 90 mm²	0.222	-	0.261	-
	3 x 120 + 70 mm²	0.182	-	0.214	-
PILC Underground Cables	25 mm²	0.765	-	0.9	-
	35 mm²	0.558	-	0.656	-
	70 mm²	0.296	-	0.348	-
	120 mm²	0.180	-	0.212	-
	185 mm²	0.125	-	0.147	-
	300 mm²	0.0853	-	0.100	-
PVC 5-Foot-Way Services	7/.044	2.68	15.6	3.15	18.4
	7/.083	0.838	4.86	0.986	5.72
	19/.064	0.570	3.47	0.671	4.08
	19/.083	0.335	2.08	3.99	2.45
	7/.173	0.201	1.30	0.236	1.53

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TABLE 2 *(JADUAL 2)*

Section	Number of Consumers	Conductor size	% Volt Drop Per kW Per 1000 m	Route Length in km		ADMD Per Consumer	ADMD of Consumer in Section	ADMD of Consumers Beyond Section	Section % Volt Drop (4x6x8) + (4x5x9)	Cumulative % Volt Drop	Network Point
				Actual	Equivalent Route Length						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

Note: Use this table to answer **Question 3** and to be submitted together with your answering script
*Nota: Gunakan jadual ini untuk menjawab **Soalan 3** dan diserahkan bersama buku jawapan*

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TABLE 3 (*JADUAL 3*)

Reference *(Rujukan)*	Catchment Area *(Luas Kawasan tadahan)*	Cumulative Catchment Area *(Kumulatif Luas Kawasan tadahan)*	Slope *(Cerun)*	*Diameter* (Garispusat)	Velocity *(Halaju)*	Pipe capacity *(Keupayaan Paip)*	Pipe Length *(Panjang Paip)*	Flow Time *(Masa Aliran)*	Concentration Time *(Masa Tumpuan)*	Rainfall Intensity *(Keamatan Hujan)*	Surface Runoff flowrate *(Kadar aliran air larian)*
	m^2	m^2	m/m	mm	m/saat	m^3/jam	m	minit	minit	mm/jam	m^3/jam
1.2 – 1.1	500		1/100	150			150				
1.1 – 2.1	500		1/100	150			150				
1.3 – 1.4	600		1/100	150			100				
1.4 – 2.1	700		1/100	150			100				
2.1 – 3.1	600		1/100	200			150				
1.5 – 1.6	500		1/100	150			150				
1.6 – 3.1	300		1/100	150			200				
3.1 – 4.1	600		1/100	300			200				

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